

A Decision-supported Outpatient Practice System

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We demonstrate a Decision-supported Outpatient Practice (DOP) system developed and in use at the Columbia-Presbyterian Medical Center (CPMC). DOP integrates in-patient and ambulatory care data, and incorporates active and passive decision support mechanisms with a view towards meeting the information needs of ambulatory care providers and improving the quality of care. The X Windows user interface is available with other clinical and scholarly resources on desktop PCs in exam rooms of an academic general internal medicine ambulatory care practice. DOP utilizes the central (mainframe computer) data repository of CPMC's Clinical Information System (CIS) with its decision support system (DSS) and knowledge base of medical logic modules (MLMs) written in the Arden Syntax. Communication with the central repository occurs via HL7 messages from an intermediate server (IBM RS/6000) that maintains a transient store of all data on selected ambulatory patients.

The main DOP review screen seeks to supply primary care information needed prior to seeing a patient in the context of an ambulatory visit: an overview of problems, medications, adverse drug reactions, recent clinical results, health care encounters, recommended preventive health interventions, vital signs, and computer-generated clinical alerts. The user interface exploits an underlying ambulatory data model that provides an explicit record of evolution of insight regarding patient management. Detail information, such as an evolution of understanding about patient problems, is available by selecting a problem from the problem list and requesting "Details" via a mouse button click.

A particular area of focus is that of improving compliance with established preventive health recommendations. An MLM calculates these recommendations for each patient based on age, gender, and medical problems, according to recommendations of the US Preventive Services Task Force. These recommendations are stored as coded data and displayed on a list in the DOP interface, which prompts for updates in preventive health activities undertaken by primary care providers. Active decision support also occurs via alerts and reminder messages regarding acute health problems, drug interactions, and overdue preventive health interventions. These alerts and

reminder messages are prominently displayed in the DOP user interface.

The graphical user interface supports entry of (coded) patient problems, medications, and adverse reactions data to drive decision support for primary care. Entry of coded data occurs via user interaction with a semantically-structured controlled vocabulary. Semantic filters based upon application context narrow the vocabulary search space initiated by users' lexical input. A graphical mode for browsing and searching medical concept space is also available. Needed medical concepts may be located by graphically browsing and navigating among vocabulary entities organized visually as a directed acyclic graph (multiple-parentage type-hierarchy).

Passive decision support mechanisms include longitudinal clinical laboratory results summaries that are also organized and driven by clinical vocabulary structure and content, not application code. Nonidentical but clinically groupable test batteries (such as "SMAC", "CHEM-20", "CHEM-7") are combined for display by defining vocabulary test classes that hold analogous tests, and test-battery classes that hold analogous or groupable test batteries. The advantage of this solution is a layer of indirection that insulates the application program from changes in clinical laboratory operations, and automatically accommodates the display of new tests as they are added to the vocabulary.

DOP provides for easy composition of ambulatory visit notes. Patient problems, medications, allergies, vital signs, and health maintenance activities are automatically incorporated into a visit note as it is being composed. Options are offered to accommodate individual stylistic variations and provide for minimal keyboard use by providers.

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References

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